The Scottish Mathematical Council

MATHEMATICAL CHALLENGE

2014–2015

Solutions

Primary Division: Problems II

P2.1. Alice, Bill, Charles and Doris each have three different coloured marbles, chosen from white, yellow, green, red and blue.

1. Bill has a red marble.
2. Doris does not have a green marble.
3. Charles has only one marble the same colour as any of Alice's and only one the same colour as any of Bill's.
4. Only two people have red marbles.
5. Charles has one yellow marble.
6. The two girls have the same colours.

What are the colours of Bill's three marbles?

Solution

From statements 1 and 5:

Alice			
Bill	red		
Charles	yellow		
Doris			

From statement 6, 4 and 2: Alice and Doris cannot have red or green marbles so they must have white, yellow and blue.

From statement 4: Charles must have a red marble.

Alice	white	yellow	blue
Bill	red		
Charles	yellow	red	
Doris	white	yellow	blue

From statement 3: Charles – the yellow is the only matching marble with Alice i.e. Charles cannot have white or blue so must be green. Similarly, the red is the only matching marble with Bill.

Alice	white	yellow	blue
Bill	red	white	blue
Charles	yellow	red	green
Doris	white	yellow	blue

So Bill must have red, white and blue.

P2.2. The average annual rainfall in a town for the ten years up to the end of 2011 was 1208 mm. In 2012 the rainfall was 1255 mm and the ten year average decreased to 1204 mm. What was the rainfall in the town in 2002?

Solution 1

The total rainfall for the years 2002 to 2011 was $10 \times 1208 = 12080$ mm.

The total rainfall for the years 2003 to 2012 was $10 \times 1204 = 12040$ mm.

The rainfall for 2012 was 1255 mm and so the rainfall for the nine years 2003 to 2011 was $12040 - 1255 = 10785$ mm.

So the rainfall for 2002 was $12080 - 10785 = 1295$ mm .

Solution 2

The ten year average has decreased by 4 mm.

Hence the ten year total has decreased by 40 mm.

Thus the rainfall in 2002 was 40mm more than in 2012, i.e. 1295 mm.

P2.3. What is the largest value of British coins you can have in your piggy-bank such that their value comes to more than £2 but you are nevertheless unable to make £2 exactly?

Solution

The highest value coins build up the total value most quickly, so start with as many of each in turn as possible whilst ensuring that £2 cannot be made exactly.

One £1 (or two 50p or five 20p); one 50p; four 20p which gives £2.30.

Note that using any 10p coins would mean £2 could be constructed.

After that we can use one 5p and eight 2p coins which contribute a further 13p.

If one more coin of any type (including 10p or 1p) is added then it is possible to make £2 exactly.

Hence the maximum total value is £2.43.